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ABSTRACT

In observations of three brain injured children (20, 32, and 24 months old), the authors found a strong association between reinforcement density and cooperative behavior during physical therapy sessions. The results suggested that the delivery of reinforcement per se has substantial effects on behavior. When large amounts of noncontingent positive reinforcement was provided each child, noncooperative behavior decreased very significantly. It appears that with some subjects, manipulation of reinforcement density may be a useful alternative or adjunct to manipulation of contingencies. (Author/DB)

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Effects of reinforcement density on cooperative behavior in brain-injured children.

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Abstract

Professionals sometimes design a behavior program without conducting a thorough behavior analysis. As a result, programs may be inappropriate and ineffective for some clients. In addition, lack of systematic analysis may prevent the field from developing new treatment strategies and advancing the understanding of human behavior. In observations of certain brain-injured children, we have found a strong association between reinforcement density and cooperative behavior. The present results suggest that the delivery of reinforcement per se has substantial effects on behavior. It appears that with some subjects, manipulation of reinforcement density may be a useful alternative or adjunct to manipulation of contingencies.

In recent years, professionals have begun to rely more on packaged prescriptions for behavior change, and less on functional analyses of behavior (see Pierce and Epling, 1980). Since the same behavior may be maintained by different contingencies in different subjects (Carr, 1977), failure to analyze may lead to a certain proportion of treatment failures (Michael, 1980). In addition, the thorough behavior analytic scientist may contribute to our presently limited understanding of human behavior and increase our range of treatment strategies; the behavioral technician seems unlikely to contribute in this way.

The basis of most behavioral interventions is manipulation of response - consequence relationships. Concentrating on contingencies has proved a useful strategy, but it focuses attention on behaviors preceding consequence delivery. Sometimes, the behaviors following and elicited by consequence delivery may be of interest. In such cases, the amount and frequency of reinforcement may be as relevant as the response-consequence relationship.

In our early intervention program for developmentally delayed infants we have encountered a situation in which amount of reinforcement seems a crucial determinant of behavior. In our program, most of the brain-injured children receive physical therapy, and most of them cry while receiving it. Unless the crying is sufficiently intense to prevent work with the child, therapists generally ignore it and praise cooperative behavior. Over time, most of the clients begin to cooperate with therapists during handling. In a few cases, however, the praise-ignore strategy appears to have no effect.

Informal observations suggested that therapists were applying appropriate contingencies to modify the crying and oppositional behavior; however, the behavior seemed most closely associated to the quality and frequency of

consequences delivered. It appeared that more cooperation and less crying were evidenced when more positive reinforcement was available. The present investigations were designed to provide more formal tests of this hypothesis.

Setting

The present investigations were conducted during regularly scheduled classes of the Early Intervention Program of the Association for the Help of Retarded Children. This is an interdisciplinary parent training program for developmentally delayed children ages 0 to 3 years. Observations for Cases 1 and 2 were conducted during physical therapy while a therapist was handling the child and at least one of the child's parents was in the room. Observations for Case 3 were conducted while the child was being seen by a staff psychologist with the child's mother present.

Measures (Cases 1 and 2)

For Cases 1 and 2, observations were conducted on a 10 second observe, 20 second record basis. During the observation interval, if the subject screamed, whined, or engaged in thrusting or other abnormal movement, the behavior was scored as uncooperative during that interval. If the subject received any event that the parent identified *a priori* as very positive (e.g., favorite toy or mother talking to, for subject one; bubbles or mother talking to, for subject two) this was scored as a high reinforcement density interval. (See below for description of measures utilized with Case 3).

Case 1: The association between reinforcement and cooperative behavior.

The first case was a 20 month old moderately hypotonic developmentally delayed female. Informal observation suggested that this subject was more cooperative when more positive activities were available. Formal data collection was conducted for three physical therapy sessions over a three week period. During this time, the subject's mother was instructed to

provide activities that her child enjoyed, and to talk to the child regardless of what the child did.

Figure 1 shows the results during these three sessions. Total uncooperative behavior declined from 75% of the intervals in the first session to 17% in the third session. Uncooperative behavior during high reinforcement density intervals declined similarly, from 70% to 9%. Note, however, that uncooperative behavior remained at 100% during low reinforcement intervals.

In the absence of comparison data, this does not demonstrate an effect of the instructions to the parent on either the rate of reinforcement delivery or on the uncooperative behavior. However, the substantial difference in uncooperative behavior between low and high reinforcement density intervals provides support for the hypothesis that the behavior and reinforcement density are related.

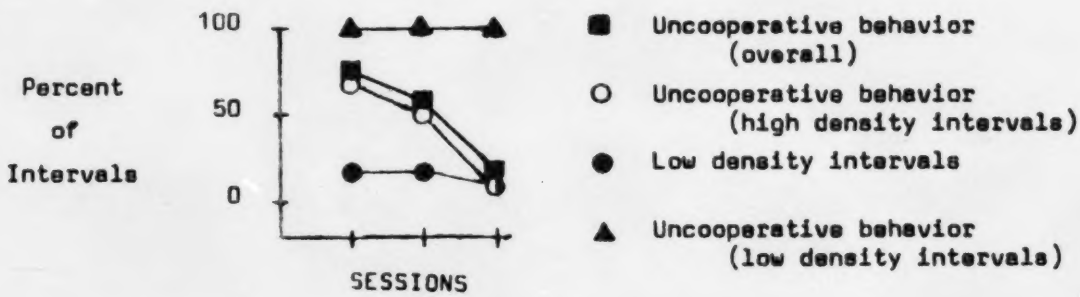

Figure 1. Uncooperative behavior and low reinforcement density in each session for case 1.

Case 2: Effects of parent training and instructions.

The second case was a 32 month old athetoid cerebral palsy male who also appeared very responsive to the density of positive events. Observations were conducted each week during physical therapy. After three sessions of baseline, the subject's mother was instructed to provide frequent positive activities during physical therapy.

Figure 2 shows the results of observations with this subject. During baseline, uncooperative behavior was observed in 81% of the intervals. During treatment, this behavior was observed in only 17% of the intervals. The change appeared to be associated with introduction of the intervention; the only anomalous data point was the one generated in treatment session four, which overlaps slightly with baseline session two. The subject's mother reported that he was ill during this fourth session of treatment.

An even more striking effect is the difference between behaviors during high and during low reinforcement intervals. Uncooperative behavior was observed during all low reinforcement intervals, but was not observed during any high reinforcement intervals other than those in treatment session four. Thus in all but one treatment session, all recorded uncooperative behavior occurred during low reinforcement intervals.

At four month follow-up, subject two still displayed uncooperative behavior during all low density intervals. An increased proportion of low

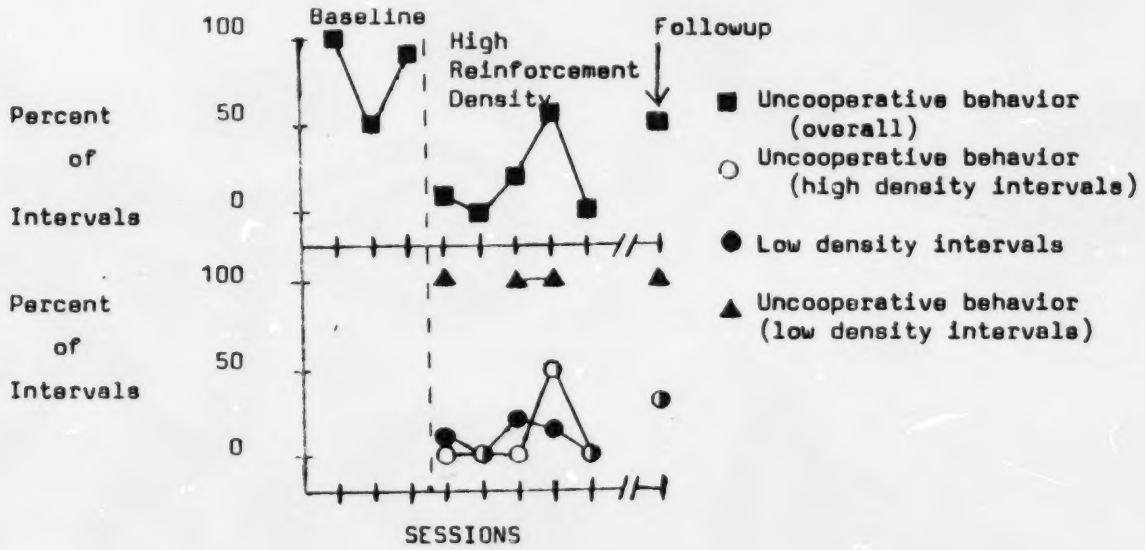

Figure 2. Uncooperative behavior and low reinforcement density intervals in each session for case 2.

density intervals suggests a failure to maintain the program of high reinforcement density. The subject continued to manifest more cooperative behavior during high density intervals; it is not clear that the effect of reinforcement is as potent at follow-up as it was early in treatment. Nonetheless, the data suggest that the high density reinforcement continued to elicit cooperation over an extended period of time.

Case 3: Possible effects of reinforcement density on client - therapist interaction.

Subject three was a 24 month old hypertonic male with a history of infantile spasms. He tended to continue uncooperative behavior patterns for extended periods of time; therefore, cumulative uncooperative behavior during the first 30 minutes of the session was timed by starting a stopwatch at the onset of an uncooperative episode, and stopping it at the end of the episode. Since this subject often began screaming upon entering the classroom, initiating treatment was often difficult.

During a four session baseline, the senior author (J.W.) attempted to work with the subject while applying a praise-ignore strategy. The fifth session was begun by (J.W.) carrying the subject around the room (a favorite event for subject three). During session six, treatment as usual with a praise-ignore strategy was re-instituted. Sessions seven through ten were begun by carrying the subject around the room.

Figure 3 shows the results of this strategy. During baseline, a mean of 79% uncooperative behavior was recorded. In the fifth session, uncooperative behavior declined to 44%. In the sixth session reversal, the rate rose to 93%. During sessions seven through ten, a mean of 10% was recorded. Thus, a sharp decrease in uncooperative behavior was associated with beginning the session with a positive event.

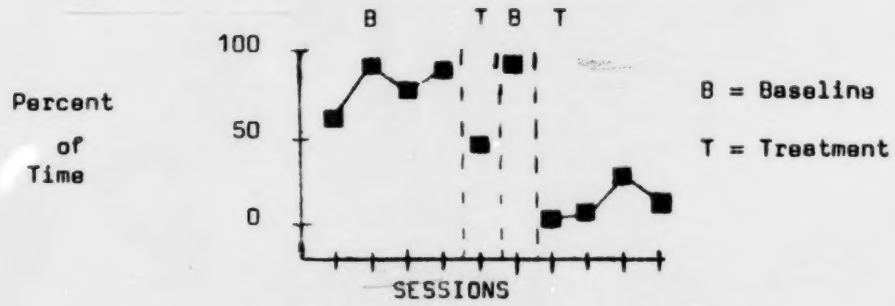

Figure 3. Uncooperative behavior during baseline (treatment as usual) and treatment (session started with noncontingent positive reinforcement) for case 3.

This is not to say that a single positive event changed a well established pattern of behavior. Rather, it appeared that the positive event elicited a brief initial period of cooperation, which could be reinforced. This seemed to establish a more positive interaction between subject and staff. Without the initial positive event, the subject would begin the session by screaming, which resulted in little opportunity to reinforce cooperation.

Discussion

We have found striking differences between behavior during delivery of high density reinforcement and during low density reinforcement. This suggests that procedures involving reinforcement density manipulation may be useful additions to the behavior analyst's armamentarium of strategies.

First, however, we must delineate the necessary and sufficient conditions for occurrence of such phenomena. Our findings are based on observations of very young brain-injured children during treatment in an early intervention program. The generalizability across settings and subject populations should be tested. Further, the maintenance of effects over time must be examined.

At this point, a number of viable interpretations of the phenomenon may be advanced. One view is that the subjects' uncooperative behavior is a means of obtaining reinforcement; the presence of noncontingent reinforcement may make the behavior unnecessary. Green (1980) and Hurah (1980) have indicated that noncontingent reinforcement is most likely to decrease responding if the response cost is very high; the response cost of the uncooperative behavior appeared to be very high. Another view is that the observed effects depend on contingent delivery of high density reinforcement for cooperative behavior; however, the clear and immediate relationship between reinforcement density in an interval and behavior makes this seem unlikely. It is also possible that the positive events elicit cooperation, and that a classical conditioning process is making the treatment situation more positively valenced. This seemed to be the case particularly with subject three.

More systematic control of response-consequence relationships is needed to test the role of contingencies in this situation. All of the subjects were brain-injured, and may have had difficulty discriminating contingencies. On the other hand, Ayllon and Azrin (1968) report that "reinforcement priming" — initial delivery of noncontingent reinforcement — is useful for initiating responding in adult mental hospital patients; hence, the effect may not be specific to brain-injured children. It is also critical to assess the effects of delivering positive consequences on the behavior of parents and staff. The procedure may affect the subject's environment in a number of ways, making it more positively valenced.

The present results could have important implications. They suggest that the response-consequence contingencies traditionally emphasized by behavior analysts are not the only important considerations in designing behavior programs; at times, the consequence per se may elicit desired behaviors.

If this effect is sufficiently powerful, it may be cost-effective to maintain noncontingent delivery of positively valenced events. The training for noncontingent delivery certainly appears to be less time consuming than training for contingent consequence delivery.

This is not to deny the importance of contingencies of reinforcement; contingencies may in fact be important to the present effects, are certainly critical to other interventions, and may be necessary when maintenance over time is desired. At the same time, the present findings suggest that the amount of reinforcement received should be given closer attention.

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